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# Modern Surgery - Chapter 18. Diseases and Injuries of the Heart and Vessels - Operations on the Vascular System

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severe, make pressure on the main artery of the limb, open the wound and ligate, wrap the part in cotton, elevate, and surround with hot bottles. If this religation is done on the femoral and fails, do not ligate higher up, as gangrene will certainly occur, but amputate at once, above the point of hemorrhage. If dealing with the brachial artery, do not amputate, but ligate higher up and make compression in the wound. In a secondary hemorrhage from the innominate, tie the innominate again and also tie the vertebral.

## 2. OPERATIONS ON THE VASCULAR SYSTEM.

**Paracentesis auriculi**, or tapping the heart-cavity, has been suggested for the relief of an overdistended heart from pulmonary congestion. The right auricle can be tapped. Push the aspirator needle directly backward at the right edge of the sternum, in the third interspace. This operation is not recommended, as it is highly dangerous and is of questionable value.

**Paracentesis pericardii**, or tapping the pericardial sac, is done only when life is endangered by effusion. Introduce the needle two inches to the left of the left edge of the sternum, in the fifth interspace, and push it directly backward (thus avoiding the internal mammary artery). The operation of tapping is extremely dangerous. The heart is lifted up and pushed forward by an effusion and the needle is apt to enter it. The puncture of a ventricle may do no harm, although it is apt to, but the puncture of an auricle is liable to be followed by fatal hemorrhage. It is wiser and safer to expose the pericardium and incise it, as is done for pericardial suppuration.

**Operation for Pericardial Effusion or Suppuration.**—The operation of tapping should be abandoned in favor of a safer but more radical procedure. There is no spot where we can introduce the needle with perfect safety, and the heart or pleura may be wounded; further, as Brentano shows,\* tapping will not completely empty the sac. In a purulent case tapping gives practically no chance of cure. No general anesthetic should be used. A portion of the fifth rib or the cartilage on the fifth rib should be excised, the pericardium exposed and punctured in order to determine the nature of the fluid present. If the fluid is serous, it can be drained away through a small incision, and the pericardium may either be sutured or drained with gauze. If the fluid be purulent, the pericardium should be stitched to the chest-wall and opened. Clots should be removed by irrigation with hot salt solution and a drainage-tube should be introduced.

**Operation for Wound of the Heart.**—In many cases it is obviously impossible to administer an anesthetic, but when possible it should be given because the movements of the patient while under the knife make operation difficult and increase bleeding. Ether may be used or we may take Hill's advice and give chloroform. Hill would give an anesthetic unless the patient is unconscious and the corneal reflex is abolished. Personally, I would be disposed to use local anesthesia unless the patient's general condition were good or at least fair. The pericardium is exposed freely and Rotter's incision gives excellent access. This exposure is described by Hill in the "Medical Record," November 29, 1902, and was employed in his successful case. Begin an incision over the third rib five-eighths of an inch from the left edge of the sternum and carry it outward along the rib for four inches. Begin an

\* Deut. med. Woch., Feb. 11, 1890.



incision over a corresponding point of the sixth rib and carry it out for a like distance. Join the outer extremities of these cuts. Cut through the ribs and pleura with bone forceps and scissors. Raise the flap upon its hinges of cartilages, and have an assistant grasp the lung to prevent collapse. The pericardium thus exposed is opened more widely if necessary. Hill advises us to steady the heart by passing the hand under it and lifting it. Parrozzani did this by passing a finger through the wound. Other surgeons have used traction sutures of silk. Interrupted sutures are preferred to the continuous suture. Either silk or catgut can be used. They should be inserted with a round-edged needle, and should, if possible, be passed and tied during diastole. "As few as possible should be passed commensurate with safety against leakage, as they cause a degeneration of the muscular fiber" (L. L. Hill, in "Medical Record," November 29, 1902). The pericardial and pleural sacs are cleansed with salt solution. The question of drainage is still *sub judice*. I would be inclined to drain the pericardium with gauze. The pleural sac is treated according to indications in each case.

**Operation for Varix of Leg.**—Many cases do not require operation. In some, operation is positively harmful. In some selected cases it is very useful to remove certain complications (ulcer, eczema, etc.), and to relieve the patient from annoyance, but the operation rarely absolutely cures the condition. The indications and contraindications are discussed on page 290. Never operate if phlebitis exists, except to treat thrombosis.

**Trendelenburg's Operation.**—I have employed this with much satisfaction in cases of varix of the leg following involvement of the saphenous in the thigh. Trendelenburg believes that in varix the valves in the saphenous become incompetent because of high central pressure. The veins of the leg distend, as they are unable to support such a long column of blood, and finally the blood begins to flow in the wrong direction in the saphenous, a "vicious circle" being established. We determine whether a case is a suitable one for Trendelenburg's operation as follows: While the patient is lying down, raise the extremity as though we intended to empty it of blood previous to amputation. After three minutes compress the saphenous vein about the lower third of the thigh by means of a moist gauze bandage, which must not be so tight as to shut off the deeper vessels. Lower the leg and have the patient stand up. If blood flows into the saphenous from above and distends the portion of the vein above the compress, the valves are incompetent and Trendelenburg's operation may be performed. The operation is performed as follows: Make an incision about four inches long over the internal saphenous vein at the junction of the lower and middle thirds of the thigh. Expose the vein, ligate each visible branch, ligate the saphenous at the lower end of the wound and also at the upper end, and remove the portion of vein included between the ligatures. By this operation the central pressure is intercepted and the dilated veins in consequence shrink. Some surgeons have advised the removal of the entire length of the long saphenous vein. If Trendelenburg's operation fails and a relapse occurs, extirpate the varicose veins of the leg, first making them prominent by applying an Esmarch band lightly about the thigh while the patient is standing. After the application of the band he lies down and is given ether.

*Madelung* cuts down over the varices and ligates at various points. *Schede* makes a circular cut (a circumcision) completely around the leg at the junction of the upper and middle thirds, the incision reaching to the deep fascia. All bleeding points are ligated and the edges of the incision are stitched together. *Fergusson* ties the saphenous vein near the femoral and removes a section from it. This makes the varices clearly evident. A semilunar incision is made to surround the varices, which incision reaches to the deep fascia. The flap is raised and dissected up, the vessels are tied, and the flap is sutured in place. The author of this operation claims that it is most satisfactory and certain. *Phelps* advises multiple ligation, which may be described as follows: At several points over the long saphenous vein he makes skin incisions in the long axis of the vessel. Each incision is two inches long. At each point two ligatures are placed one inch apart and the portion of vein between them is removed.

**Open Operation for Varicocele.**—The open operation is by far the best procedure for varicocele. The instruments used are a scalpel, an aneurysm needle, curved needles, a grooved director, a dissecting forceps, Allis's dry dissector, hemostatic forceps, and scissors.

**Operation.**—The patient is placed in a recumbent position. He may be given a general anesthetic or *Schleich's* fluid may be injected. The operator stands on the diseased side. The assistant stands on the sound side and makes pressure over the inguinal ring of the affected side. A fold of skin is pinched up on the scrotum, and the surgeon transfixes it in the line of the cord, so that he will have an incision about one and a half inches long running downward from below the external ring. The skin and fascia are cut with a scalpel, the veins are well exposed by means of an Allis dissector, and the cord is located and held aside. A double ligature of strong catgut or chromicised gut is passed under the veins by an aneurysm needle. The threads are separated one inch, tied tightly, and the ends are left long. The veins between the ligatures are excised. The two gut ligatures are tied together and cut. This shortens the cord. The scrotum is sewed up with silkworm-gut, a small drainage-tube being used for twenty-four hours. Healing is complete in one week.

*Bloodgood*, of Johns Hopkins Hospital, points out that it is well to avoid dividing the genital branch of the genitocrural nerve which supplies the cremaster muscle. If this nerve should be divided, the cremaster will become lax and return of the varicocele will be favored. *Bloodgood* makes the incision over the external ring, draws the veins up and resects them. A wound so placed heals more certainly and promptly than does a wound of the scrotum.

**Subcutaneous Ligature for Varicocele.**—In this operation employ every antiseptic precaution. The patient stands, and the operator, sitting in front of him, holds the veins in a fold of skin away from the vas deferens by means of the thumb and index-finger of the left hand. A large straight needle carrying a double piece of strong silk is passed entirely through the scrotum, between the veins and the vas. The needle is again inserted at the puncture from which it emerged, is carried around under the skin and in front of the veins, and emerges at its original point of entry. The veins are thus surrounded by the silk. The patient, who now lies down, is placed



under the first stage of ether, and the double ligatures are separated as far as possible from each other, tied, and cut off, the knots slipping in through the puncture. This operation presents certain dangers. The veins may be wounded and the vas or other structures may be included. In an operation it is always best to be able to see what we are doing; and the open operation, being safe, is preferred to the subcutaneous.

**Phlebotomy, or Venesection.**—The instrument used in venesection is a lancet or bistoury. A fillet or tape, an antiseptic pad, and a bandage are required. A stick should be at hand for the patient to grasp.

**Operation.**—The patient sits on a chair “with the arm abducted, extended, and inclined outward” (Barker). The parts are aseptized and a tape is tied around the arm just above the elbow. The surgeon stands to the right of the arm, holds the elbow with his left hand, and puts his thumb upon the vein below the intended point of puncture. The patient grasps a stick firmly and works his fingers in order to cause the veins to distend. Either the median cephalic or the median basilic may be opened (Figs. 126, 127). The median basilic is the more distinct, and is the vein usually selected. In opening it do not cut too deep, as nothing but the bicipital fascia separates it from the brachial artery. The median cephalic may be selected (we thus avoid endangering the brachial artery); under



Fig. 126.—Incisions for venesection (Bernard and Huette).

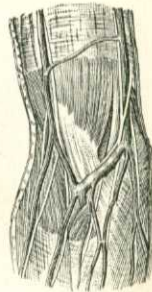


Fig. 127.—Superficial veins in front of elbow (Bernard and Huette).

this vein lies the external cutaneous nerve (Fig. 127). Steady the vein with the thumb and open it by transfexion, making an oblique cut which divides two-thirds of it. Remove the thumb and allow bleeding to go on, instructing the patient to work his fingers. When faintness begins, remove the fillet, put an antiseptic pad over the puncture, apply a spiral reversed bandage of the hand and arm and a figure-of-eight bandage of the elbow, and place the arm in a sling for several days.

**Transfusion of Blood.**—This operation has been a recognized procedure since 1824, though it has been known since 1492, when transfusion was employed in the case of Pope Innocent VIII. Its chief use was in severe hemorrhage, especially post-partum, in which it served to replace the blood lost and supplied something for the heart to contract upon until new blood formed. Senn insists that the operation has proved an absolute failure. It does not prevent death from hemorrhage, and the transferred blood-elements do not retain vitality. Von Bergmann showed that after severe hemorrhage we do not need to inject nutritive elements, but do need to restore the greatly diminished intracardiac and intravascular pressure. At the present day a saline fluid is infused in preference to transfusing blood. In fact, the operation of transfusion has become all but extinct. It exposes the patient to the danger of embolism and infection, its employment requires

material and instruments often difficult to obtain in an emergency, and it has no single element of value beyond that secured by the use of salt solution, except in cases overcome by illuminating gas, in which a more prolonged good effect is produced than by salt solution.

**Intravenous infusion of saline fluid** is used after severe hemorrhage, in shock, in diabetic coma, in post-operative suppression of urine, and occasionally in sepsis. After a hemorrhage its beneficial effects are often prompt and obvious. This saline fluid increases the arterial tension, gives the heart enough matter to contract upon, and so restores the activity of the circulation, and does not destroy the red corpuscles as plain water would do. We may use a simple apparatus consisting of a rubber tube, a funnel, and an aspirating needle. Some employ an Aveling syringe, and others Collin's apparatus (Fig. 128). The last-named instrument can be used without any danger of air entering with the fluids. Spencer's instrument (Fig. 129) is convenient and useful. Normal salt solution is the fluid usually employed,

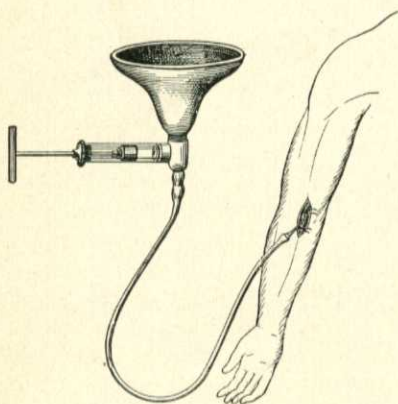


Fig. 128.—Intravenous injection of saline fluid.

of a strength of 0.6 per cent. (a heaping teaspoonful of common salt to a quart of warm boiled water). Some surgeons employ an artificial serum which contains 50 grains of chlorid of sodium, 3 grains of chlorid of potassium, 25 grains of sulphate of sodium, 25 grains of carbonate of sodium, and 2 grains of phosphate of sodium in a quart of boiled water. Szumann's solution consists of 6 parts of common salt, 1 part of sodium carbonate, and 1000 parts of water. The following solution is used by Locke and Hare: calcium chlorid, 25 gm.; potassium chlorid, 1 gm.; sodium chlorid, 9 gm.; sterile water sufficient to make 1 liter. One bottle of the commercial fluid when

diluted to 1 liter gives a solution of the above composition. The results from artificial serum containing many elements are no better than from normal salt solution. Whatever fluid is used, it should be at a temperature of 105° F. or over as it enters the vein. The stimulant effect of the heat is of great value. The fluid must not be allowed to cool; and a nurse gives constant attention to the temperature of the fluid in the reservoir. This degree of heat will not damage the corpuscles; in fact, Dawbarn has used saline fluid at a temperature of 118° F. without doing damage to corpuscles and with great benefit to the patient. From  $\frac{1}{2}$  pint to 2 pints or even more are slowly injected, the condition of the patient determining the amount given. In one case of violent hemorrhage the author used over 2 quarts. In order to infuse this fluid, tie a fillet well above the elbow, and expose by dissection the median basilic vein, or the basilic vein in the portion of its course where it is superficial to the deep fascia. Tie the vein. Incise it above the ligature, insert a fine cannula, and hold the cannula firmly in lumen by tightening a second ligature (Figs. 63, 128). Remove



the fillet. Slowly and gradually introduce the fluid, carefully watching the pulse. Occupy at least ten minutes in introducing a pint, except in a very desperate case of hemorrhage, when the rapidity of the flow may be accelerated. When the tension of the pulse returns, withdraw the cannula, tie the second ligature tightly, sew up the wound, and dress it aseptically. In very severe operations an assistant should conduct the infusion while the surgeon is operating. It may be necessary to repeat the operation if the circulation fails again. The infusion of a very large amount of saline fluid may do harm. It may embarrass the heart and may lead to edema of the lungs or brain.

#### Arterial Transfusion and Infusion of Saline Fluid in Arteries.

—Hueter preferred the arterial method of transfusion, in order to send the blood more gradually to the heart, and thus prevent sudden disturbance of the circulation. A little air in an artery will do no harm, and the danger of venous embolism is avoided. Saline fluid can be infused into an artery. The radial artery is exposed and surrounded by three ligatures, and the thread toward the heart is at once tied. The distal ligature is slightly tightened to cut off anastomotic blood-supply. The artery is cut transversely half through; the syringe is inserted, pointed toward the periphery, and fastened by the third ligature; the second ligature is loosened and the blood is injected. On finishing, the peripheral thread is tied tightly and that portion of the artery which held the cannula is excised. Dawbarn puts a hypodermatic needle into the radial artery and injects saline fluid.

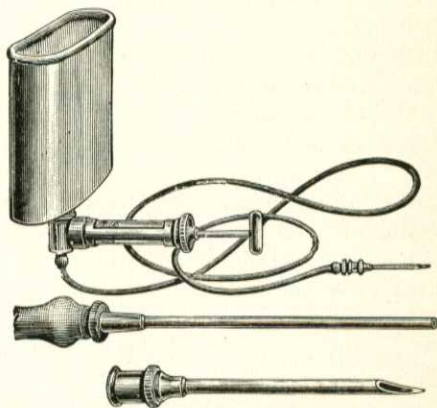


Fig 129.—Spencer's apparatus for the infusion of saline fluid into a vein. The cannula can be plunged directly into the vessel without preliminary incision.

**Hemophilia, or Hemorrhagic Diathesis.**—The term hemophilia expresses the existence in an individual of a tendency to profuse or even uncontrollable hemorrhage spontaneously or as a result of some very trivial injury.

Hemorrhage may take place from mucous or serous membranes or from wounds of the cutaneous surface, into tissue, into organs, under the scalp, or into the external genitals. In a hemophiliac, if a cut is made, the hemorrhage from the larger vessels is easily arrested, but capillary oozing continues.

The condition is far more common in males than in females, and if it exists in a female, which it rarely does, it is not usually provocative of dangerous hemorrhage. The disease is transmitted by heredity. It is transmitted to a son by a mother, who is usually free from the disease, but whose father had it, and the son bleeds dangerously from slight causes. The existence of the tendency is rarely suspected until the first dentition, and possibly not till puberty; "70 per cent. of cases appear before the fifth year."\* The

\* R. C. Cabot, in "International Text-book of Surgery."

discovery of the existence of such a condition may not be made until a tooth is pulled, and extraction is followed by persistent bleeding. It is alleged that the tendency may disappear in middle life.

The cause of the condition is unknown. It has been assumed that there is a condition of the blood which prevents coagulation, but the blood of a hemophiliac coagulates outside of the body as well as any other blood. Furthermore, Agnew had a case in which hemophilia was limited to the head and neck, and there have been cases in which the bleeding occurred from one kidney. Some maintain that there is structural defect in the capillaries. In a case of hemophilia in the Jefferson Medical College Hospital in which it was absolutely necessary to amputate a finger because of a crush, a careful study of the vessels of the finger by Dr. Coplin failed to show any disease of the blood-vessels. A surgeon must be on the lookout for this condition, and should inquire for it before deciding to do an operation. If it exists, only an operation of imperative necessity should be undertaken.

A child who is a "bleeder" must be unceasingly watched and guarded. A tendency to profuse oozing exists in leukemia because of the condition of the blood, but this is not hemophilia. A tendency to oozing also exists during jaundice.

**Treatment.**—The oozing is difficult and often impossible to control. The internal administration of such drugs as ergot, gallic acid, and acetate

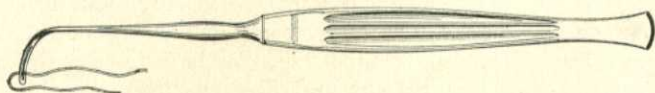


Fig. 130.—Aneurysm needle of Saviard.

of lead is useless. It is claimed that chlorid of calcium internally is of service. The local use of astringents is of no avail. Prolonged elevation may in rare cases succeed. In the case in the Jefferson Medical College Hospital the bleeding was arrested, after numerous expedients failed, by compression and hot water. Nurses sat by the bed for several days, constantly compressed the wound with gauze pads soaked in hot water, and changed the pads as soon as they cooled. The local use of Carnot's solution of gelatin has saved several cases from death. It has been advised to take some blood from a healthy man and put it in the cut, in the hope that a firm clot will form.

### 3. LIGATION OF ARTERIES IN CONTINUITY.

The **instruments** used in this operation are two scalpels (one small, one medium), two dissecting forceps, several hemostatic forceps, blunt hooks or broad metal retractors, an Allis dissector, an aneurysm needle, for superficial arteries the instrument of Saviard (Fig. 130), for deep vessels the needle of Dupuytren (Fig. 131), ligatures of catgut, of chromicized gut, or of silk, curved needles and a needle-holder, sutures of silkworm-gut, and the reflector or electric forehead-lamp for deep vessels.

The **position** in which the patient is placed varies according to the vessel to be ligated, though the body is supine except when ligation is to be performed